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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/146,839	09/03/98	SRINIVASAN A	MI22-1017

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EXAMINER	
MAI, A	
ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 06/02/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Offic Action Summary	Application No. 09/146,839	Applicant(s) SRINIVASAN ET AL.	
	Examiner Anh D. Mai	Art Unit 2814	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d f r Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

1)☒ Responsive to communication(s) filed on *17 April 2000* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disp sition of Claims

4)☒ Claim(s) *1,3-8,10,11,13-28 and 35-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-8,10,11,13-28 and 35-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a)☐ All b)☐ Some * c)☐ None of the CERTIFIED copies of the priority documents have been:

1.☐ received.

2.☐ received in Application No. (Series Code / Serial Number) _____ .

3.☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

14) ☒ Notice of References Cited (PTO-892)
15) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
16) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
17) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
18) ☐ Notice of Informal Patent Application (PTO-152)
19) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. The amendment filed April 17, 2000 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

Claims 1 and 18 recite: "temperature from above (or *in excess of*) 400 degree C to not greater than (or *but less than*) about 700 degree C".

Claim 21: "temperature *in excess of* 400 degree C"

However, the specification does not support that.

Applicant is required to cancel the new matter in the reply to this Office Action.

Specification

2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: "temperature from *above* (or *in excess of*) 400 degree C to *not greater than* (or *but less than*) about 700 degree C".

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3-7, 10, 13-17, 23-28 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf (U.S. Patent No. 5,849,644) in view of Kirchhoff et al. (U.S. Patent No. 6,057,250).

Schuegraf teaches a method of forming a fluorine doped insulating material similar as claimed including:

providing a substrate (24) within a reaction chamber, the reaction chamber controlled within a range of temperatures from above 400 degree C;

providing reactants comprising silicon, fluorine and oxygen within the reaction chamber; and

depositing an insulating material, at a rate of from about 1000 to about 10000 Angstroms per minute, comprising fluorine, silicon and oxygen onto the substrate from the reactants. (See col. 3, l. 1-col. 5, l. 55).

Thus Schuegraf is shown to teach all of the features of the claim with the exception of using ozone as one of the reactant gas.

However, Kirchhoff '250 teaches using ozone as an oxygen source for the reactant gas. (See col. 5, ll. 24-37).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to use ozone source gas as a reactant gas in place of the

oxygen source gas of Schuegraf as taught by Kirchhoff because ozone is well known in the art to be used as a reactant gas since the decomposition rate of ozone is faster than other oxygen source such as H2O.

Regarding the limitation of the insulating material comprising fluorine, silicon and oxygen, since FTES can be used as a precursor in place of TEOS, thus the resulting insulating material of Schuegraf should obviously contain fluorine.

With respect to claim 3, the deposition of Schuegraf occurs with a plasma being present in the reaction chamber.

With respect to claims 4-6, the precursor of Schuegraf includes FTES, thus silicon and fluorine are comprised within a common molecule.

With respect to claim 7, since FTES is used as a precursor thus, the resulting insulating material should obviously contain an Si-F bonds.

With respect to claim 10, the pressure within the reaction chamber of Schuegraf is within the claimed range.

With respect to claim 13, the reactants of Kirchhoff further comprise phosphorous thus result in a insulating material comprises fluorine, silicon, oxygen and phosphorous.

With respect to claim 14, the reactants of Kirchhoff further comprise boron thus result in a insulating material comprises fluorine, silicon, oxygen and boron.

With respect to claim 15, the reactants of Kirchhoff further comprise boron and phosphorous thus result in a insulating material comprises fluorine, silicon, oxygen, boron and phosphorous.

With respect to claims 16 and 17, the reactants of Kirchhoff comprise a molecule that includes both Si and F (FTES), and another molecule that includes Si without F (TEOS).

With respect to claim 23, the reactants of Kirchhoff further comprises a phosphorous-containing precursor, thus the insulating material deposited is a phosphorous-doped silicon oxide having Si-F bonds and the reaction chamber of Kirchhoff does not contain plasma.

With respect to claim 24, the phosphorous-containing precursor of Kirchhoff is TEPO.

With respect to claim 25, the reactants of Kirchhoff further comprises a phosphorous-containing precursor, a phosphorous-containing precursor, thus the insulating material deposited is a boron and phosphorous-doped silicon oxide having Si-F bonds and the reaction chamber of Kirchhoff does not contain plasma.

With respect to claim 26, the boron-containing precursor of Kirchhoff is triethyl TEB.

With respect to claim 27, the phosphorous-containing precursor of Kirchhoff is TEPO.

With respect to claim 28, the phosphorous-containing precursor of Kirchhoff is TEPO and the boron-containing precursor of Kirchhoff is TEB.

With respect to claim 36, the insulating material of Schuegraf has a deposition rate of about 7000 Angstroms per minute thus can be seen as similar to about 8000 Angstroms since no criticality is established.

Further, it would have been obvious to determine the optimum deposition rate of the insulating material. See In re Aller, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 and Kirchhoff '250, as applied to claim 1 above, and further in view of Homma (U.S. Patent No. 5,288,518).

Schuegraf and Kirchhoff are shown to teach all of the features of the atomic percentage of fluorine in the insulating material.

However, Homma '518 teaches the atomic percentage of fluorine in the fluorine-containing silicon oxide film is within the claimed range. Further, no criticality has been established.

5. Claims 11, 35, 37, 41 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 and Kirchhoff '250, as applied to claims 1 and 25 above, and further in view of Vassiliev (U.S. Patent No. 5,876,798).

With respect to claims 11, 35 and 41, Schuegraf and Kirchhoff are shown to teach all of the features of the claim with the exception of maintaining the reaction chamber at a higher pressure.

However, Vassiliev, teaches maintaining the reaction chamber at a pressure of 10 to 760 Torr to form a satisfactory film. (See col. 5, ll. 5-7).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to maintain the reaction chamber of Schuegraf at the pressure as taught by Vassiliev to form a satisfactory insulating film.

With respect to claims 37 and 42, the substrate of Vassiliev is maintained in a reaction chamber at a temperature of about 500 degree C.

6. Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 in view of Kirchhoff '250.

Schuegraf teaches a method of forming a silicon oxide having Si-F bonds similar as claimed including:

providing a reaction chamber at a of temperatures in excess of 400 degree C;

position a substrate (24) within the reaction chamber;

providing a precursor having Si-F bonds to the substrate within the reaction chamber; and

causing a silicon oxide having Si-F bonds, to deposit onto the substrate within the reaction chamber at a rate of from about 1000 to about 10000 Angstroms per minute. (See col. 3, l. 1-col. 5, l. 55).

Thus Schuegraf is shown to teach all of the features of the claim with the exception of providing an ozone comprising reactant.

However, Kirchhoff '250 teaches providing an ozone comprising reactant in a reaction chamber to form a silicon oxide having Si-F bonds. (See col. 5, ll. 7-23).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to use ozone reactant gas in place of the oxygen source gas of Schuegraf as taught by Kirchhoff because ozone is well known in the art to be used as a reactant gas since the decomposition rate of ozone is faster than other oxygen source such as H2O.

Regarding the limitation of the silicon oxide having Si-F bonds, since FTES can be used as a precursor in place of TEOS, thus the resulting insulating material of Schuegraf should be silicon oxide having Si-F bonds.

With respect to claim 19, the precursor of Schuegraf is FTES, thus having Si-F bonds.

With respect to claim 20, the deposition of Kirchhoff is without plasma.

7. Claims 38-40 and rejected under 35 U.S.C. 103(a) as being unpatentable over Schuegraf '644 and Kirchhoff '250, as applied to claim 18 above, and further in view of Vassiliev (U.S. Patent No. 5,876,798).

With respect to claims 38 and 39, Schuegraf and Kirchhoff are shown to teach all of the features of the claim with the exception of maintaining the reaction chamber at a higher pressure.

However, Vassiliev, teaches maintaining the reaction chamber at a pressure of 10 to 760 Torr to form a satisfactory film. (See col. 5, ll. 5-7).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to maintain the reaction chamber of Schuegraf at the pressure as taught by Vassiliev to form a satisfactory insulating film.

With respect to claim 40, the substrate of Vassiliev is maintained in a reaction chamber at a temperature of about 500 degree C.

8. Claims 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kirchhoff '250 in view of Schuegraf '644.

Kirchhoff teaches a method of forming a boron-doped silicon oxide having Si-F bonds similar as claimed including:

providing a substrate (11) within a reaction chamber, the reaction chamber having a temperatures in excess of 400 degree C;

providing reactants comprising triethoxy fluorosilane (FTES), a boron-containing precursor and ozone within the reaction chamber; and

causing a boron-doped silicon oxide having Si-F bonds to deposit onto the substrate. (See col. 5, l. 7-col. 7, l. 5).

Thus Kirchhoff is shown to teach all of the features of the claim with the exception of the deposition rate of the silicon oxide layer.

However, Schuegraf '644 teaches deposition rate of a silicon oxide of around 7000 Angstroms per minute at the temperature in excess of 400 degree C. (See col. 5, ll. 4-16).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the boron-doped silicon oxide of Kirchhoff at the deposition rate as taught by Schuegraf '644 to shorten the process time.

With respect to claim 22, the boron-containing precursor of Kirchhoff is TEB.

Response to Arguments

9. Applicant's arguments with respect to claims 1, 3-8, 10, 11, 13-28 and 35-42 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M.
Anh D. Mai
May 25, 2000

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